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The Influence of Performance Measurement on the Processual Dynamics of Strategic Change

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Abstract. We draw on a five-year longitudinal data set to investigate the influence of performance measurement in the processual dynamics of strategic change, particularly in enacting effective strategic change. Our model examines the role of performance measurement in driving strategy-consistent operational changes and in ensuring that the desired objectives of the strategic change process are achieved. We investigate these roles for performance measurement over time and empirically document lags between changes in strategic priorities, changes in operational processes, and subsequent changes in firm performance. We find that performance measurement supports the implementation of strategic change by influencing the extent to which changes to operational tasks and activities are made in response to new strategic priorities, as well as influencing the quality and impact of these operational changes, as reflected in improved contemporaneous and future firm performance.

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Keywords: performance measurement • strategic change • firm performance

1. Introduction

Strategic change is a critical concern for firms, and yet the processes associated with strategic change are not well understood. Management scholars continue to debate whether, and particularly under which conditions, strategic change leads to positive performance outcomes (Barker and Duhaime 1997, Trahms et al. 2013, Herrmann and Nadkarni 2014). Part of the difficulty stems from the prevalence of studies that investigate the performance outcomes of strategic change without considering implementation processes. Generally missing in empirical models but critical to understand are the broader organizational changes required to successfully implement strategic change (Pearce and Robbins 1993). Recent research reinforces the importance of explicitly recognizing the temporal progression of elements of strategic change, often referred to as the processual dynamics of strategic change (Kunisch et al. 2017). In considering the management of strategic change, prior accounting research emphasizes the need to examine the role of management control systems (Chenhall 2003).

This paper examines the role of performance measurement (PM) in the processual dynamics of strategic change. Specifically, we examine whether PM influences the extent of operational changes made to implement changes in a firm's strategic priorities as well as subsequent performance outcomes of the strategic change process. To enhance our understanding of the dynamics of strategic change, our empirical model explicitly incorporates "temporal progressions of activities" (Langley et al. 2013, p. 1). We include changes in a firm's strategic priorities that occur as part of the strategic decision-making process, what we refer to as *strategic change*, as well as the subsequent organizational changes that occur at lower levels of the firm, which we refer to as *operational change*. In examining strategic change, operational change, and performance outcomes longitudinally, we respond to calls to incorporate a time dimension into empirical models of strategic change (Herrmann and Nadkarni 2014, Kunisch et al. 2017). Our focus is on the role of PM in translating strategic change into subsequent operational changes and also in ensuring that operational changes drive subsequent firm performance such that desired objectives of the strategic change process are achieved.

The accounting literature has examined how a firm's choice of strategy influences management control system choices, including the design of PM systems (for reviews of this literature, see Chenhall 2003, Langfield-Smith 2007, and Otley 2016). It has also recognized

that PM can facilitate the formulation and implementation of a firm's strategy.[1] Researchers have argued that broad-based PM promotes the testing, validation, and revision of hypothesized strategic relations (Kaplan and Norton 1996, 2001; Campbell et al. 2015). The balanced scorecard (BSC) has largely provided the framework for studying these relations. It is argued that linking strategically aligned measures across different perspectives of firm performance supports strategy implementation, provides decision makers with the ability to evaluate whether a strategy is working or not, and allows for timely revisions to courses of action (Kaplan and Norton 1996, Campbell et al. 2015). However, although studies of the BSC conceptualize the process of measurement as linked in a causal chain, they do not attempt to model how changes in strategic priorities influence changes in operations. Furthermore, despite significant attention to the BSC framework, empirical research generally cannot find consistent evidence of causal links between performance metrics in a BSC (Malina et al. 2007).

There are also very few longitudinal studies of PM and few studies that capture changes in operations as an outcome of changes in strategic priorities. Most empirical research in accounting investigates PM at fixed points in time and assumes, rather than measures, performance outcomes as driven by the alignment of operations with strategy. Exceptions are a number of case studies examining longitudinal change processes, which we draw on in developing our hypotheses (e.g., Chenhall and Langfield-Smith 2003, Campbell et al. 2015). In other words, processual dynamics are generally not well captured in models of strategic change and PM. There are, however, several good examples of research that documents the dynamic context of management control. For example, Sandino (2007) studies management control in growing firms, Simons (1994) in strategic renewal decisions, and Henri (2006) in the development of organizational capabilities.

Our study is distinct from prior research because we use a broad-based sample of firms, tracked over time, to examine PM in a model that studies the processual dynamics of strategic change. We recognize that strategic change is a complex phenomenon and do not claim to capture all the intricacies of the change process. Drawing on extant theory, we predict an order of events that occur when a firm makes changes in its strategic priorities. We are interested in change—how strategic change translates into subsequent operational changes and how both strategic and operational changes are supported by PM. We do not limit our analysis to typologies that classify strategic change (e.g., whether firms are moving from a defender-type strategy to a prospector-type strategy[2]) but rather examine the extent to which firms that make changes in their strategic priorities make changes in their operational processes to implement these changes. Our study enables us to shed light on the importance of PM in driving changes in operational processes and delivering performance improvements in firms undergoing strategic change.

Given that strategic change takes time to be implemented and for performance effects to occur, we employ a longitudinal (five-year) large-sample database to assess our hypotheses. Based on a sample of 457 firms tracked annually for a five-year period, we find support for our expectations. Our results indicate that PM is critical in the implementation of effective strategic change. We find that use of PM influences not only the extent to which operational changes are made in response to changes in strategic priorities but also the effectiveness of these operational changes, as evidenced by subsequent improvements in firm performance.

Our study contributes to the literature in several ways. The development of our empirical model allows us to more closely integrate the strategic change literature with the accounting literature that studies the relation between strategy and management control choices (Herrmann and Nadkarni 2014, MacBryde et al. 2014). We heed the advice in the strategic change and operations management literatures as to the importance of including both changes in strategic priorities and changes in operational processes and provide large-scale quantitative evidence of the role of PM in effectively implementing these changes (Pearce and Robbins 1993, Trahms et al. 2013, Anand and Gray 2017). Our findings speak to the theorized importance of PM in galvanizing strategy-consistent operational change (Campbell et al. 2015). Our findings also inform the recent stream of management research that strives to better understand why strategic change is more successful in some firms than in others (Barker and Duhaime 1997, Trahms et al. 2013, Herrmann and Nadkarni 2014).

Furthermore, we contribute to the literature on the processual dynamics of strategic change by recognizing strategic change as a series of interconnected decisions that unfold over time (Chandler 1962, Galbraith and Schendel 1983). Most studies in both the accounting and management literatures examine either the processes of strategic change or the consequences of strategic change through the use of cross-sectional data (Rajagopalan and Spreitzer 1997, Zajac et al. 2000, Ittner 2014). Hutzschenreuter and Israel (2009) argue that only by studying actions and reactions can we draw any conclusions about the effect of strategic change on performance outcomes. Our use of a longitudinal database allows us to assess whether changes in firms' strategic priorities are associated with subsequent operational-level actions as well as subsequent performance outcomes and the period of time

over which the impact of strategic change plays out within an organization. Although we acknowledge that our empirical results cannot demonstrate causal links unequivocally, given the importance of time in understanding strategic change, our longitudinal data allow us to at least partially address issues of processual dynamics. Luft (1997) notes that longer time frames permit identification of causal relations that may be missed in cross-sectional work and also provide a more robust setting in which to examine change and stability in management accounting practice. Our findings speak to the importance of studying processes of strategic change both in their entirety and longitudinally rather than independently and/or cross-sectionally.

2. Hypothesis Development

Figure 1 depicts our conceptual model. We describe the model by first examining the relation between changes in strategic priorities and subsequent operational changes and how PM influences this relation. We then examine the relation between operational changes and firm performance, again examining the influence of PM. Our model incorporates a time dimension through the lags we introduce with each relation.

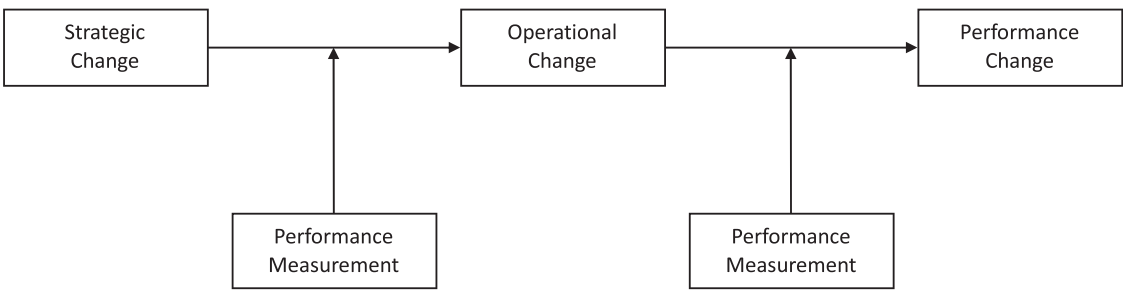
2.1. Defining Strategic Change, Operational Change, and PM

Studies of the processual dynamics of strategic change assume that there are distinct and predictable phases of change (Kunisch et al. 2017). Although these phases are characterized in a range of ways, a broadly accepted and widely researched distinction is made between the *initiation* and *implementation* of strategic change (Rajagopalan and Spreitzer 1997, Herrmann and Nadkarni 2014). In the initiation phase, changes to a firm's strategic priorities are made in response to changing environmental and organizational contingencies (Zajac et al. 2000). In the implementation phase, operational changes are made to carry out changes to strategic priorities (Herrmann and Nadkarni 2014). For convenience, we refer to changes to a firm's strategic priorities in the initiation phase as *strategic change* and to operational changes made to implement new strategic priorities as *operational change*.

We follow management scholars who conceptualize changes to a firm's existing strategic priorities as relating to both the content and scope of changes (Barker and Duhaime 1997, Rajagopalan and Spreitzer 1997, Herrmann and Nadkarni 2014). Following Herrmann and Nadkarni (2014), this includes changes to both the domain of a firm's strategy and high-level structural elements of the firm that support strategic priorities. They argue that both types of change occur at the strategic level of decision making within the firm and are complementary choices. Prior literature identifies a range of possible changes to a firm's strategic priorities, including those reflected in market entries and exits; the addition and elimination of product lines or segments; mergers and acquisitions; the purchase and divestment of property, plant, and equipment; or changes to research and development (R&D) expenditures (Rajagopalan and Spreitzer 1997, Hitt et al. 2010, Herrmann and Nadkarni 2014). Substantive high-level structural adaptations associated with changes in strategic priorities include changes to the level of centralization/decentralization within a firm and changes to the senior leadership's focus (Barker and Duhaime 1997, Rajagopalan and Spreitzer 1997, Herrmann and Nadkarni 2014).

An extensive literature in operations management examines operational-level actions and processes designed to implement firm-level strategic choices efficiently and effectively (for a review, see Anand and Gray 2017).[3] This literature stresses that operational changes are designed and implemented to align operations capabilities with broader strategic priorities (Skinner 1969, Anderson et al. 1989, Anand and Gray 2017). Operational changes can include changes to design, technology, manufacturing, and delivery processes; reconfiguration of operational processes; and changes to managerial processes (Anderson et al. 1989, Bititci 2007). Bititci (2007), for example, recognizes organizational, people, process, system, resource, and infrastructure changes that occur at the operational level. Similarly, Dixon et al. (1994) identify operational-level changes that include reconfigurations of operations,

Figure 1. Conceptual Model of Strategic Change



new-product development, technology integration, and process redesign. Building on this literature, we investigate a range of operational changes related to the implementation of strategic change. These changes relate not just to changes to operations and processes but also to the design, manufacture, and delivery of products and services and to managerial processes.

Studies of the processual dynamics of strategic change make various assumptions about the temporal sequencing of elements of strategic change (Kunisch et al. 2017). Whereas some studies assume that changes to strategic priorities and operational change are contemporaneous (e.g., Romanelli and Tushman 1994), others assume a sequential ordering to these elements (e.g., Pettigrew 1985, Hinings and Greenwood 1988, Brown and Eisenhardt 1997, Amis et al. 2004).[4] Those assuming a sequential ordering contend that higher-order changes are required first, to both signal the new priorities and convey the importance of strategic change (Pettigrew 1985, Amis et al. 2004, Kunisch et al. 2017). The emphasis in the operations management literature on aligning operations capabilities to a firm's strategic priorities reinforces the contention that the elements of strategic change are temporally sequenced.[5] Thus, we develop our model accordingly.

PM systems are defined and operationalized within the literature in a variety of ways. They may be defined by the features of the system, such as the inclusion of multiple financial and nonfinancial measures or the extent to which measures are integrated. They may also be defined by the role or use of the system, for example, to translate business strategies, align management processes, or assess achievement of organizational objectives (Franco-Santos et al. 2012). No one definition of a PM system, or even a typology of systems, has gained traction in the literature.[6]

We adopt the general term *performance measurement* to reflect the breadth of measures and approaches possible across the firms we study, purposefully avoiding definitions such as *contemporary*, *comprehensive*, or *strategic* that impose constraints on the features and use of a system. We define PM inclusively as any system that incorporates financial and/or nonfinancial measures used to operationalize strategic objectives and to evaluate performance achievements against those objectives. Prior research suggests that financial and nonfinancial measures can induce different behavioral and performance effects and are often used in combination. Nonfinancial measures are often more timely and more directly linked to a firm's operating processes, whereas financial measures are considered to capture broader outcomes (e.g., cost reduction, sales, and profit) that can be the objective of strategic change (Kaplan and Norton 1996). Studies that build on the notion of the BSC demonstrate that both financial and nonfinancial measures are useful for directing attention to operational actions that support strategic change as well as the achievement of strategic objectives (e.g., Bhimani and Langfield-Smith 2007, Campbell et al. 2015). Similarly, the broader PM literature finds that broad scope information (i.e., combining financial and nonfinancial measures) encourages the strategic alignment of operations and the achievement of strategic outcomes (e.g., Chenhall 2005, Naranjo-Gil and Hartmann 2007). Accordingly, we build on an inclusive notion of PM to develop our hypotheses but in supplementary analyses also test for potential differences in the influence of financial and nonfinancial measures.

2.2. Processual Dynamics of Strategic Change and PM

The rhetoric of PM emphasizes its effect on organizational outcomes as stemming from its role in both facilitating strategy-consistent decision making to inform organizational actions and in motivating, tracking, and evaluating effective strategy implementation (Grafton et al. 2010). However, many of the processes through which PM influences performance outcomes remain unstudied, and findings of the outcomes of PM use remain equivocal (Ittner et al. 2003, Grafton et al. 2010, Franco-Santos et al. 2012). Hamilton and Chervany (1981) contend that information systems have both intermediate and end-of-process effects; that is, information systems influence the task and activities performed within the organization (means) as well as the organizational outcomes (ends), with the ends typically requiring a longer period of time to realize. This supports the importance of assessing the influence of PM at both the level of its effect on operational change and the level of its effect on firm performance, and doing so over time.

Consistent with the different roles of PM identified in prior research, we predict that PM will influence the processual dynamics of strategic change by drawing attention to strategically aligned operational actions and tasks, motivating efficient and effective execution of operational changes, and allowing for more effective evaluation to assess how well new operational processes are being implemented (Kaplan and Norton 1996, Franco-Santos et al. 2012, Ho et al. 2014, MacBryde et al. 2014). Recent reviews of the accounting literature, however, highlight that organizations differ in the extent to which they realize benefits from PM (Franco-Santos et al. 2012, Franco-Santos and Otley 2018). Our focus on the role of PM in supporting distinct and predictable phases of strategic change begins to unpack the intermediate and end-of-process effects of PM and is one way in which

its effects can start to be unraveled and equivocal findings can be resolved.

2.3. PM for Enacting Effective Operational Change

Prior work on strategy implementation in the accounting literature provides support for the general expectation that PM influences operational processes (Kaplan and Norton 1996, Chenhall 2005, MacBryde et al. 2014, Campbell et al. 2015). However, few studies have examined the nature or extent of operational changes made in response to strategic change and the role of control choices in this relation. The studies that do are predominantly case studies (e.g., Chenhall and Langfield-Smith 2003, MacBryde et al. 2014, Campbell et al. 2015). Other studies, particularly those investigating the BSC, find that PM supports the translation of strategy into operational terms (Kaplan and Norton 1996, Malina and Selto 2001, Chenhall 2005). These studies examine PM choices to capture strategic priorities and guide the implementation of strategy. Measures may include those capturing drivers or outcomes of operational change. However, this stream of literature similarly does not capture the extent to which the use of PM subsequently results in the implementation of operational changes.

Our model specifically examines the relation between changes in strategic priorities and the subsequent changes that are made to operations to implement these changes. We do so given evidence that for strategic change to be effective, firms must devote particular attention to implementation as a phase of the processual dynamics of strategic change (Herrmann and Nadkarni 2014, MacBryde et al. 2014, Kunisch et al. 2017). These process changes operate at different levels of the organization and in different time periods (Hutzschenreuter and Israel 2009, Melnyk et al. 2014, Kunisch et al. 2017).[7] We predict that operational changes will follow changes in strategic priorities and include operational processes and actions that support the implementation of these priorities (MacBryde et al. 2014, Melnyk et al. 2014, Campbell et al. 2015, Anand and Gray 2017). PM can play a critical role in guiding the implementation of operational changes. It can direct managers' attention by communicating new strategic priorities and desired actions, as well as monitoring the effects of actions and incentivizing behaviors that are aligned with strategic goals and plans (e.g., Malina and Selto 2001, Widener 2007, Campbell 2008). Accordingly, we expect that PM will moderate the relation between changes to strategic priorities and the extent of subsequent changes in operational processes and actions. In other words, we expect the operational changes that flow from changes in strategic priorities to be greater when supported by PM.

Outcomes of strategic change are influenced not only by the extent of operational change enacted in response to new strategic priorities but also by the impact or quality of these operational changes. We therefore also investigate the influence of PM on the translation of operational change into firm performance outcomes. Extant research demonstrates that PM linked to the strategic orientation of the firm can assist in the achievement of strategic objectives (e.g., Nørreklit 2000, Ittner and Larcker 2001, Lillis 2002, Langfield-Smith 2007). Prior research also supports the idea that PM guides and motivates the long-term effort of managers and employees (e.g., Ittner and Larcker 2001, Malina and Selto 2001), particularly in firms implementing change (Matejka et al. 2009). This suggests that PM not only influences the extent of operational change to implement changes in strategic priorities but also should influence the effectiveness of those operational changes. We assess effectiveness by examining the relation between realized operational changes and subsequent changes in firm performance. Thus, our second expectation is that changes in operational processes are more likely to result in performance improvements when PM is used to a greater extent. In sum, we examine whether the use of PM matters not only to achieving more operational change in response to strategic change but also to achieving more effective changes that enhance firm performance. Our expectations about the influence of PM are summarized in the following two hypotheses.[8]

Hypothesis 1. *Use of PM positively influences the association between strategic change and the extent of subsequent operational changes.*

Hypothesis 2. *Use of PM positively influences the association between the extent of operational changes and firm performance.*

Figure 1 depicts our expectation that use of PM will moderate the mediation effect of strategic change on firm performance through supporting a higher quantity and quality of operational change.

3. Research Method

We test our hypotheses using data from the Business Longitudinal Database (BLD) constructed by the Australian Bureau of Statistics (ABS). The BLD contains data collected via an annual Business Characteristics Survey (BCS)[9] of small to medium-sized enterprises in Australia as well as matched firm data from Business Activity Statements (BASs) submitted to the Australian Taxation Office. Small to medium-sized enterprises are defined by the ABS as firms employing fewer than 200 employees and make up more than 99% of all registered businesses in Australia

throughout the period 2003–2012 (Australian Bureau of Statistics 2013).

The BLD design is based on the use of consecutive samples (panels) of data. Each panel is stratified by industry division and business size such that it represents the characteristics of the Australian business population at the time the panel is introduced into the BLD. A new panel is added each year and remains in the BLD for five years. The BLD covers all actively trading businesses in the Australian economy (i.e., firms that are registered for an Australian Business Number and remit goods and services tax).[10] The BLD does not include organizations classified as general government, not-for-profit, or public administration and safety, nor does it include financial corporations or utility companies.

The BCS is a mail-out/mail-back questionnaire. Nonresponse in any given year is negligible, given that all firms included in the sample are required by law to complete and return the survey. The purpose of the survey is to enable an analysis of business performance, including the capacity of businesses to undertake activities that lead to performance growth and the relative importance of these activities in driving that growth (Australian Bureau of Statistics 2011). The survey contains a consistent set of core questions to allow longitudinal analysis.[11] The questionnaire largely comprises categorical variables. We provide details of each of the survey items used to measure constructs in the sections that follow. All matched BAS data from the Australian Taxation Office included in the BLD are subject to perturbation techniques (value adjustment) by the ABS to protect the confidentiality of firms. Intrinsic data distributions are preserved (between businesses and over time) during the perturbation process (Australian Bureau of Statistics 2011).

In our analysis, we use a panel of the BLD (Panel 1) that spans the financial years 2004/2005–2008/2009 and in total includes 2,732 firms (Australian Bureau of Statistics 2011). For ease of reference, we refer to these financial years as 2005–2009. We exclude businesses employing fewer than 20 persons because these can be considered microbusinesses, unlikely to require the formal processes that we investigate.[12] This results in an initial sample of 625 firms. There were 56 firms that were bankrupt in 2005 and provided no data, there were 65 firms that either did not respond or were out of scope in 2006, and there were missing data for 47 firms on at least one measurement item in 2005 or 2006. We are thus left with complete observations for 457 firms over the period 2005–2006. Additional firms dropping out in the subsequent years (e.g., firms moving out of scope of the BLD or having missing data on performance variables) cause somewhat smaller sample sizes for the firm performance tests for those years (i.e., 432 for 2007, 419 for 2008, and 420 for 2009). We retain firms that do not survive until the end of the five-year window but for which data on other constructs in our model are available. We use data on firm failure as part of our measurement of firm performance change, and given the significant proportion of failing firms, in an additional test, we also examine the potential effects of survival bias.

The BLD population and sample for our study, stratified by sector and business size, are shown in Table 1. Because response rates for each BCS are close to 100% (e.g., 98% in 2005 and 95% in 2006 and 2007), we do not test for sampling problems associated with nonresponse. We test our hypothesized model with the following lags between the model components. The variables capturing the initiation of strategic change are based on 2005 data, operational changes and use of PM are captured in 2006, and changes in firm performance are captured in 2006–2009. Although we have no strong a priori theory or empirical support to predict these time lags, these seem reasonable periods for the initiation of strategic changes to flow through to operational-level changes and subsequent performance outcomes.

4. Variable Measurement

Construct measures were developed based on the available items in the survey and other archival data in the database. For each key construct in the model, we use other available survey or BAS measures to conduct additional validity tests.

4.1. Strategic Change

We measure strategic change that was initiated in 2005 and include items that capture changes in the content of the firm's strategy and high-level structural adaptations within the firm. Six indicators capture whether (0 = no; 1 = yes) in 2005 the firm made significant changes to the following: (1) range of products or services offered, (2) area of distribution, (3) method of distribution, (4) market targeted, (5) management structure, and (6) business structure.[13] The first four items reflect changes to the firm's market activities and relate well to the critical market-repositioning choices (domain) identified in prior research, whereas the latter two items capture structural adaptations within the firm that often are needed to accommodate market repositioning (Barker and Duhaime 1997, Rajagopalan and Spreitzer 1997, Herrmann and Nadkarni 2014).[14] Strategic change can involve any or a combination of these changes, and our construct measure considers a larger number of changes to reflect greater strategic change. All the items represent changes that occur at the strategic level of decision making, and we treat the changes as

Table 1. BLD Business Population and Sample Counts for Panel 1 (2005–2009)

	Business size				
	20–199 persons			All groups[a]	
	Panel 1[b]	Analysis sample	Population	Panel 1	Population
Agriculture, forestry, and fishing	149	100	4,031	622	189,420
Mining	15	10	118	120	5,509
Manufacturing	96	71	3,964	449	101,973
Construction	39	25	1,608	142	291,154
Wholesale trade	64	51	2,485	285	78,837
Retail trade	39	33	4,374	174	208,095
Accommodation, cafés, and restaurants	41	34	2,994	183	52,873
Transport and storage	39	30	900	156	109,332
Communication services	20	12	68	139	23,164
Property and business services	43	31	6,477	158	404,878
Cultural and recreational services	42	32	638	141	43,796
Personal and other services	38	28	472	163	54,826
Total in-scope sample/population	625	457	28,129	2,732	1,563,857

[a]"All groups" includes business sizes of 0–4 persons and 5–19 persons, as well as nonemploying businesses.
[b]The sample count (i.e., Panel 1 data) as of June 30, 2005.

one construct. Tetrachoric correlations between the six dichotomous items are all positive and significant (for all correlations, $p < 0.01$), suggesting that these changes often occur simultaneously. A maximum likelihood (ML) factor analysis on the tetrachoric correlations, in which we relate all items to the construct, provides significant factor loadings for all items, ranging between 0.53 and 0.86. Composite reliability of the construct is 0.86, indicating high measurement reliability. As a validity test, we correlate the construct measure with the sum of two indicators of whether the firm in 2005 introduced any changes in the method and volume of advertising, which likely accompany changes in the content of strategy (e.g., to advertise new products and reach new markets). The positive correlation supports convergent validity ($r = 0.44$; $p < 0.01$).

4.2. Operational Change

Operational change includes lower-level changes within the firm that relate primarily to concrete changes implemented in the processes affecting the manufacturing or production of goods and services and other operational support activities. The measure is distinct from the changes initiated at strategic levels within the firm. The focus on realized operational changes aligns with the notion of actual implementation of change.[15] In our empirical model, *operational change* is measured one year after the measurement of strategic change (i.e., in 2006) as the mean of seven indicators that capture whether (0 = no; 1 = yes) the firm introduced in the year any new or significantly improved (1) methods of manufacturing or producing goods or services, (2) supporting activities for business operations, (3) other operational processes, (4) knowledge management processes, (5) major changes to the organization of work, (6) changes to the design or packaging of a good or service, and (7) marketing methods for sales or distribution. A greater number of these modifications reflect the implementation of more extensive operational changes. Tetrachoric correlations between the seven indicators are all positive and significant (all $p < 0.01$), suggesting that different types of operational changes are often made in conjunction. Confirmatory ML factor analysis of the tetrachoric correlations shows that all items load significantly on the same factor, with loadings ranging between 0.47 and 0.74. The composite reliability of 0.82 indicates high construct reliability.

As a validity test of the measure, we correlate the operational change construct with a five-item measure of the firm's expenditures on activities that facilitate innovative changes in processes.[16] The positive and significant correlation ($r = 0.21$; $p < 0.01$) indicates that the introduction of operational changes is associated with expenditures on such activities.

4.3. Performance Measurement

We measure the intensity of use of PM in the year that we measure operational change (i.e., 2006) and use six items that reflect the extent to which the firm focused on the following measures when evaluating business performance (0 = not at all; 1 = to a small extent; 2 = to a moderate extent; 3 = to a major extent): (1) financial measures, (2) cost measures, (3) operational measures, (4) quality measures, (5) innovation measures, and (6) human resources measures. Jointly, these six items are reflective of the firm's extent of use of PM. ML factor analysis shows that all items load significantly on one construct, with factor loadings ranging

between 0.58 and 0.76. Composite reliability is 0.83, indicating high construct reliability. We use the mean of the items to generate a construct score and use this measure to test both hypotheses. We use four other items captured in 2005 to provide evidence of construct validity. These items measure whether the firm in 2005 used the following practices: (1) written strategic or business plans, (2) budget forecasts, (3) comparison of performance with other businesses, and (4) regular assessment of achievement of targets or objectives. Each of these practices requires a greater use of PM information. Indeed, the positive and significant correlations ($r = 0.31$, 0.25, 0.22, and 0.35; all $p < 0.01$) provide evidence of convergent validity because they indicate that planning, budgeting, benchmarking, and regular performance evaluation are associated with greater use of PM information.[17]

4.4. Firm Performance Change

Firm performance change is measured in the same year as the operational change variable as well as in the three subsequent years. We use three items that require respondents to indicate how performance changed compared with the previous year in (1 = decreased; 2 = stayed the same; 3 = increased): (1) income from the sales of goods or services, (2) profitability, and (3) productivity. Because these items jointly reflect yearly change in overall firm performance, we conduct ML factor analysis to assess construct validity. All items load significantly on the construct (loadings are 0.74, 0.77, and 0.73), and reliability is also high (composite reliability = 0.79). As a test of convergent validity, we correlate the 2006–2009 firm performance change measures with the same-year change in firm sales (percentage increase on prior year), as reported by firms to the Australian Tax Office. This reflects a more narrow but "harder" measure of firm performance (Ittner and Larcker 2001).[18] The positive and significant correlations for all four years ($r = 0.41$, 0.45, 0.49, and 0.49; all $p < 0.01$) provide support for construct measurement. A critical limitation of this measure of performance change arises from sample attrition as a result of firm failures (up to 11% from 2007 to 2009; see Table 2), potentially introducing survival bias in the statistical tests. To mitigate this bias, for all firms with ratings missing on the three items as a result of bankruptcy, we impute the minimum construct score (i.e., 1), following the idea that firm failure is closest to deteriorating performance on all dimensions.[19] We note that estimating our performance change models without this imputation procedure provides very similar results as reported, despite the exclusion of failing firms and the reduction of yearly sample sizes.

Table 2. Descriptive Statistics

Model variable	*N*	Mean	SD	Min	Max
Strategic change 2005	457	0.15	0.22	0	1
Operational change 2005	457	0.20	0.34	0	1
Operational change 2006	457	0.16	0.20	0	1
Performance measurement 2006	457	2.03	0.68	0	3
Performance change 2006	457	2.24	0.69	1	3
Performance change 2007	432	2.14	0.73	1	3
Performance change 2008	419	2.02	0.76	1	3
Performance change 2009	420	1.86	0.75	1	3
Resource constraints 2005	457	0.14	0.15	0	1
Delegation 2005	457	0.52	0.50	0	1
R&D 2005	457	0.18	0.39	0	1
Locations 2005	457	1.47	0.77	1	3
Competition 2005	457	2.61	0.69	1	3
Firm age 2005	457	3.14	0.96	1	4
Firm size 2005	457	14.96	1.63	4.99	19.07
Firm type 2005	457	0.68	0.47	0	1
Firm failure	457	0.11	0.32	0	1

Notes. Descriptive statistics are provided for variables relating to the year of measurement (in parentheses). For the control variables (*competition* and *firm size*), the measurement year is matched with the year of the dependent variables that they relate to in the model (noting that firm type is constant over time). For these variables, we report the 2005 descriptive statistics, while noting that values for the subsequent years are comparable. SD, standard deviation.

4.5. Control Variables

We include several control variables in the model that proxy for the context faced by the firm. First, the variable *resource constraints* includes a number of constraints that influence the financial viability of the firm and restrict its ability to achieve its strategic priorities. The dimensions included in the measure are similar to those identified by Duncan (1972). We measure this variable in the same year as the initiation of strategic change (i.e., 2005) using the mean of 10 indicators capturing whether (0 = no; 1 = yes) in that year the following factors hampered the activities or performance of the firm: (1) cost or availability of finance, (2) federal government regulations or compliance, (3) state/territory government regulations or compliance, (4) local government regulations or compliance, (5) market dominated by other businesses, (6) lack of customer demand for goods or services, (7) market too small or unknown, (8) market power of suppliers or customers, (9) lack of equipment, machinery, or technology, and (10) lack of skilled staff.[20] These factors may be present independently or in any combination, and a greater number reflects more extensive constraints for the firm to overcome.

Second, *delegation* is measured in 2005 and captures whether a single person in the business was responsible for major decisions on business operations. Firms with greater delegation may be more inclined to change but also should derive greater value from PM. Third, we control for whether the firm is involved

in research and development (variable *R&D*), captured by an indicator variable indicating whether the firm in 2005 carried out any research and experimental development. Firms focused on R&D may also be more inclined to change and implement more operational innovations, influencing firm performance. Fourth, although the *resource constraints* variable incorporates some information on market dominance of other firms, we additionally control for the intensity of *competition* captured by the number of competitors (1 = captive market/no effective competition; 2 = one or two competitors; 3 = three or more competitors). Fifth, we capture the number of *locations* operated by the firm in 2005 (1 = one location; 2 = two locations; 3 = three or more locations). Other control variables that capture firm characteristics include *firm age*, captured by a measure of the number of years that the firm has been in operation (1 = less than 5 years; 2 = 5 years to less than 10 years; 3 = 10 years to less than 20 years; 4 = 20 years or more); *firm size*, measured as the log of total sales by the firm (extracted from the Australian Taxation Office data included in the BLD); *firm type*, as an indicator to differentiate between registered companies and other legal forms (e.g., partnerships); and indicators for *firm industry*, as classified in Table 1 (with natural resources as the reference group). Several of these control variables are constant over time (e.g., *firm type*, *firm industry*), do not change between firms over time (e.g., *age*), or have measurements only in 2005 (e.g., *R&D*, *delegation*). For *competition* and *firm size*, we are able to obtain time-varying measures and match the year of measurement with the year of the respective dependent variable. Appendix A summarizes variable measurement.

Table 2 reports descriptive statistics for each variable, and Table 3 reports variable correlations. Strategic change is undertaken by sample firms to a modest degree (mean = 0.15), consistent with the infrequent nature of significant changes to firms' market activities and structural adaptations. Operational change is present to a similar extent (mean = 0.16), indicating that significant improvements in operational processes are also not commonplace. Strategic change, operational change, and use of PM show positive and significant correlations, indicating that these choices and outcomes are related. In addition, these variables are also correlated, mostly positively, with yearly firm performance changes. Resource constraints are correlated particularly with strategic change, in line with the idea that constraints motivate the initiation of strategic change, and for most years are correlated negatively with performance change. The correlation coefficients further indicate that firms are less likely to fail when they introduce operational changes, make greater use of PM, and over time improve performance. The correlations among the independent variables provide no concerns about multicollinearity.

5. Results

We test our hypotheses using ordinary least squares (OLS) regressions in which we examine the influence of strategic change on next year's (i.e., 2006) operational change and the subsequent effects on changes in firm performance from 2006 until 2009. Because we expect that effective implementation of strategic change will depend on the use of PM, we conduct split-sample tests for groups with high versus low use of PM (based on the mean score for PM) and compare coefficient estimates. A key benefit of this approach is that it allows us to directly examine subgroup coefficients while also allowing the effects of control variables to differ between subgroups (e.g., firms with

Table 3. Variable Correlations

	SC	OC	PM	PC6	PC7	PC8	PC9	RC	Del	RD	Loc	Com	Age	FS	FF
Strategic change 2005	1														
Operational change 2006	0.29	1													
Performance measurement 2006	0.18	0.12	1												
Performance change 2006	0.09	0.12	0.18	1											
Performance change 2007	0.02	0.13	0.11	0.43	1										
Performance change 2008	0.07	0.16	0.07	0.23	0.38	1									
Performance change 2009	0.10	0.05	0.13	0.19	0.13	0.24	1								
Resource constraints 2005	0.27	0.07	0.05	–0.10	–0.05	–0.09	–0.01	1							
Delegation 2005	–0.05	–0.01	0.03	0.06	0.11	0.07	0.09	–0.05	1						
R&D 2005	0.09	0.21	0.13	0.04	–0.01	0.05	0.07	0.13	–0.03	1					
Locations 2005	0.02	0.01	0.06	0.02	0.08	0.09	0.05	–0.04	0.07	0.06	1				
Competition (year matched)	0.08	0.09	0.11	–0.02	–0.03	–0.05	–0.06	0.10	0.05	0.00	0.08	1			
Firm age 2005	–0.04	0.03	0.08	0.03	–0.04	0.06	0.04	0.01	–0.02	0.11	0.11	0.04	1		
Firm size (year matched)	0.10	0.15	0.25	0.23	0.28	0.30	0.22	–0.06	0.05	0.00	0.29	0.24	0.12	1	
Firm failure	0.00	–0.16	–0.12	–0.22	–0.34	–0.40	–0.43	0.04	–0.05	–0.11	–0.07	–0.04	–0.10	–0.10	1

Notes. $N = 457$, except for the correlations with *performance change* 2007, 2008, and 2009 ($N = 432$, 419, and 420, respectively). In the main sample, absolute correlations equal to or greater than 0.12 and 0.09 are significant at the 0.01 and 0.05 levels (two-tailed), respectively. For brevity of reporting, the firm type and industry indicators are omitted.

high and low use of PM can also differ in how they manage internal and external factors such as resource constraints, R&D, and competition).[21] We conduct Wald tests to test for significance of coefficient differences between subgroups. Additionally, we use structural equation modeling (SEM) to estimate indirect effects, which allows us to assess the theorized mediation effects of strategic change on performance change, through operational changes that firms implement.[22]

We conduct the analyses through the online interface of the ABS called the Remote Access Data Laboratory, in which we submit Stata code to both prepare the data for analysis and run the hypothesis tests.[23] Models 1 and 2 in Table 4 report the estimates of the effects of strategic change in 2005 on operational changes in the subsequent year, first for the full sample and then for the subsamples with high and low use of PM. The full-sample estimates show that strategic change relates positively to subsequent operational change (coefficient 0.24; $p < 0.01$). Firms reporting to be involved in R&D in 2005 are also more likely to implement operational changes in 2006 (0.10; $p < 0.01$).

The two columns for Model 2 in Table 4 report the estimates for firms with high and low use of PM. Consistent with Hypothesis 1, strategic change relates significantly to subsequent operational change for high-PM firms (0.30; $p < 0.01$) but not for low-PM firms (0.07, $p > 0.10$). To formally test Hypothesis 1, we conduct a Wald test of the coefficient difference between the subgroups. This test shows that the effect of strategic change on operational change is greater in the high-PM group than in the low-PM group ($\chi^2(1) = 6.27$; $p < 0.01$), providing support for Hypothesis 1.

One potential concern with the specifications in Models 1 and 2 in Table 4 is that, for unobserved

Table 4. The Effect of Strategic Change on Subsequent Operational Change

	Operational change 2006					
	Model 1	Model 2		Model 3	Model 4	
		High vs. low PM			High vs. low PM	
	Full sample	High PM	Low PM	Full sample	High PM	Low PM
Intercept	−0.19*	−0.08	−0.22*	−0.15	−0.04	−0.19*
	(−1.95)	(−0.51)	(−1.93)	(−1.59)	(−0.25)	(−1.72)
Strategic change 2005	0.24***	0.30***	0.07	0.17***	0.23***	0.02
	(5.48)	(4.81)	(1.11)	(3.83)	(3.58)	(0.27)
Operational change 2005				0.16***	0.18***	0.12***
				(5.72)	(4.26)	(3.28)
Resource constraints 2005	−0.04	−0.04	−0.002	−0.05	−0.05	−0.01
	(−0.63)	(−0.34)	(−0.03)	(−0.76)	(−0.49)	(−0.07)
Delegation	0.01	0.004	0.00	0.01	0.01	0.003
	(0.41)	(0.13)	(0.04)	(0.65)	(0.37)	(0.12)
R&D	0.10***	0.07*	0.11***	0.06***	0.03	0.09***
	(3.94)	(1.95)	(3.43)	(2.59)	(0.94)	(2.83)
Locations	−0.01	−0.02	−0.003	−0.01	−0.02	−0.01
	(−0.85)	(−1.03)	(−0.24)	(−0.80)	(−0.82)	(−0.36)
Competition	0.01	0.004	0.02	0.01	−0.002	0.02
	(1.04)	(0.16)	(1.41)	(0.72)	(−0.09)	(1.16)
Firm age	0.002	0.01	−0.002	0.003	0.01	0.001
	(0.18)	(0.48)	(−0.14)	(0.34)	(0.50)	(0.05)
Firm size	0.02**	0.02	0.02*	0.01**	0.02	0.01
	(2.34)	(1.23)	(1.79)	(1.98)	(0.98)	(1.61)
Firm type	0.02	0.01	0.02	0.02	0.01	0.02
	(0.92)	(0.26)	(1.00)	(0.89)	(0.23)	(0.86)
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes
F-test	3.98***	1.77**	2.06***	5.63***	2.69***	2.57***
R^2	0.15	0.15	0.17	0.21	0.21	0.21
Adjusted R^2	0.12	0.06	0.09	0.18	0.13	0.13
N	457	229	228	457	229	228
Wald-test coefficient, difference of *strategic change* for high versus low PM		$\chi^2(1) = 6.27$***			$\chi^2(1) = 4.58$**	

Notes. For each variable in the first column there are two rows. The first row presents the coefficient estimate and the second row (in parentheses) presents the *t*-value of OLS regressions.

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$ (two-tailed for coefficient estimates, one-tailed for coefficient difference tests).

reasons, firms may be more likely to engage in both strategic and operational changes; that is, despite the inclusion of relevant control variables that can affect change (e.g., *R&D*, *competition*), the association between initiated strategic change and subsequent operational change may be due to unobserved firm fixed effects. To control for this possibility, we reestimate the models and add operational change in 2005 as a control variable. If unobserved firm characteristics consistently influence operational changes over time, controlling for prior-year operational change should effectively capture such fixed firm effects. Accordingly, in this specification, the coefficients can be interpreted as the *incremental* operational changes made in 2006 (i.e., beyond any unobserved firm effects that systematically affect operational change). This includes operational changes over and above those driven by fixed firm effects, which are ongoing from prior years (i.e., whether relating to strategic change or not). Models 3 and 4 report the results. The estimates using the full sample indicate that although the effect of operational change in 2005 on operational change in 2006 is significant (0.16; $p < 0.01$), strategic change in 2005 remains significantly associated with subsequent operational change (0.16; $p < 0.01$). The results for Model 4 show that also after controlling for prior-year operational change, only in the high-PM group is strategic change significantly associated with operational change (0.23; $p < 0.01$). The reported Wald tests again show that the coefficients differ significantly between the groups ($\chi^2(1) = 4.58$; $p < 0.05$). In sum, these results indicate that unobserved heterogeneity is unlikely to bias the findings, and they reinforce the conclusions regarding the hypothesis test.

Table 5 reports the associations between operational change and changes in same-year and future firm performance for the high- and low-PM subgroups. We include in the estimation the direct effect of strategic change to control for influences of these changes on performance not mediated by operational change. The estimates show positive and significant associations between operational change and changes in firm performance in 2006, 2007, and 2008 only for high-PM firms. The coefficients are insignificant for low-PM firms in all three years, with a significant negative association in 2009. A Wald test of the coefficient differences between the subgroups for the performance effects of operational change shows that the coefficient differences over the four years are significant at the 1% level ($\chi^2(1) = 6.17$; $p < 0.01$). Separate Wald tests (reported at the bottom of Table 5) similarly indicate significant coefficient differences for three of four years (for 2006, $p < 0.05$; for 2008, $p < 0.10$; and for 2009, $p < 0.01$). These results jointly indicate that in our sample, operational changes are effective only for high-PM firms and have a window of multiple years within which they contribute to enhancing firm performance. Jointly with the results in Table 4, these findings indicate that high-PM firms not only implement more operational changes in response to strategic change but also implement more effective changes, that is, changes that enhance firm performance. This provides support for Hypothesis 2.[24]

In summary, our hypotheses predict that strategic change will influence future firm performance through implemented operational changes and that these effects will be stronger for firms that make greater use of PM. Although the results reported in Tables 4 and 5 provide evidence for both hypotheses, we additionally use SEM to compute indirect effect estimates that allow us to assess the predicted moderated mediation effects.[25] For the high-PM group, the indirect effect estimates reported in the last row of Table 5 indicate significant mediation effects of operational change on performance change for 2006, 2007, and 2008 (all $p < 0.05$). For the low-PM group, none of the indirect effect estimates is statistically significant. The difference in indirect effects between subgroups is significant for 2006, 2007, and 2008 (untabulated, all three group differences in indirect effects are significant at $p < 0.05$).[26] These results support the predicted moderation effects of PM. In particular, for firms that make greater use of PM, strategic change results in greater operational changes, which, in turn, more strongly influence firm performance change.

Table 5 includes several other findings of interest that we describe as exploratory. First, low-PM firms seem to suffer more from resource constraints, as indicated by the negative and significant coefficients on performance change for 2006 ($p < 0.05$) and 2008 ($p < 0.10$). The insignificant coefficients for high-PM firms suggest that they are more resilient to such constraints. Delegation is positively associated with performance across years for high-PM firms, consistent with theory on the complementarity between delegation decisions and PM (Abernethy et al. 2004). Similarly, conducting R&D relates to greater firm performance in 2006 for high-PM firms, indicating that use of PM helps to support effective R&D efforts.[27] Competition, however, appears to have a more severe performance impact for high-PM firms. Although, in line with previous research (e.g., Chenhall 2003), in our sample, more intense competition is associated with enhanced PM information ($r = 0.11$; $p < 0.05$; see Table 3), the estimates suggest that competition also puts pressure on performance growth. Finally, larger firms in both groups seem to systematically outperform smaller firms in performance growth.

The survey measures limit our ability to assess the impact of PM on the outcome variables. In order to

Table 5. Effects of Operational Change on Firm Performance Change

	ΔPerformance 2006		ΔPerformance 2007		ΔPerformance 2008		ΔPerformance 2009	
	High PM	Low PM	High PM	Low PM	High PM	Low PM	High PM	Low PM
Intercept	1.01**	1.24**	0.66	0.42	0.63	−0.23	0.50	0.51
	(2.09)	(2.53)	(1.24)	(0.81)	(1.14)	(−0.46)	(0.97)	(1.08)
Operational change 2006	0.42**	−0.19	0.48**	0.27	0.56**	0.05	0.23	−0.67**
	(2.06)	(−0.62)	(2.15)	(0.88)	(2.22)	(0.17)	(0.93)	(−2.09)
Strategic change 2005	−0.10	0.45*	−0.43*	0.29	−0.14	0.42	0.01	0.41
	(−0.49)	(1.70)	(−1.94)	(1.06)	(−0.59)	(1.53)	(0.04)	(1.45)
Resource constraints 2005	−0.31	−0.66**	0.26	−0.38	−0.17	−0.64*	−0.35	0.05
	(−1.04)	(−2.02)	(0.77)	(−1.09)	(−0.47)	(−1.83)	(−0.97)	(0.15)
Delegation	0.15	−0.08	0.29***	−0.01	0.19*	0.04	0.20*	−0.02
	(1.62)	(−0.85)	(2.87)	(−0.12)	(1.71)	(0.37)	(1.80)	(−0.17)
R&D	0.29***	−0.18	0.14	−0.23	−0.04	0.18	0.11	0.12
	(2.71)	(−1.24)	(1.12)	(−1.56)	(−0.33)	(1.15)	(0.82)	(0.75)
Locations	0.01	−0.11	0.05	−0.03	0.06	−0.03	−0.004	0.03
	(0.13)	(−1.62)	(0.69)	(−0.46)	(0.81)	(−0.47)	(−0.06)	(0.45)
Competition	−0.10	0.06	−0.18**	0.004	−0.18**	−0.07	−0.16**	−0.05
	(−1.51)	(0.90)	(−2.52)	(0.05)	(−2.33)	(−0.90)	(−2.07)	(−0.73)
Firm age	0.37	0.01	0.07	−0.12**	0.05	0.02	0.08	−0.03
	(0.77)	(0.11)	(1.25)	(−2.34)	(0.79)	(0.39)	(1.37)	(−0.56)
Firm size	0.07*	0.06	0.10**	0.15***	0.10**	0.16***	0.12***	0.09***
	(1.96)	(1.64)	(2.47)	(3.96)	(2.48)	(4.83)	(3.24)	(2.88)
Firm type	−0.07	−0.002	−0.11	−0.05	−0.01	0.07	−0.08	0.02
	(−0.72)	(−0.03)	(−1.00)	(−0.45)	(−0.08)	(0.58)	(−1.62)	(0.16)
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-test	2.46***	1.76**	2.34***	3.41***	1.86**	2.54***	1.99**	1.55*
R^2/adjusted R^2	0.20/0.12	0.15/0.07	0.21/0.12	0.20/0.12	0.17/0.08	0.22/0.14	0.18/0.09	0.15/0.05
N	229	228	212	220	211	208	209	211
Wald-test coefficient, difference of *operational change* for high versus low PM	$\chi^2(1) = 2.75$**		$\chi^2(1) = 0.39$		$\chi^2(1) = 1.98$*		$\chi^2(1) = 7.35$***	
Indirect effect estimate of *strategic change* 2005	0.13**	−0.01	0.14**	0.02	0.16**	0.003	0.07	−0.04
	1.99	−0.57	2.04	0.73	2.08	0.17	0.96	−0.86

Notes. For each variable in the first column there are two rows. The first row presents the coefficient estimate and the second row (in parentheses) presents the *t*-value (*Z*-value for indirect effects). Measurement of *competition* and *firm size* is matched with the year of the dependent variable. A Wald test shows that the subgroup differences between the coefficients of operational change over the four years are significant at the 1% level ($\chi^2(1) = 6.17$; $p < 0.01$).

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$ (two-tailed for coefficient estimates, one-tailed for coefficient difference tests).

obtain an approximation of this impact, we compare R^2 values of the subsample estimations (i.e., high-PM and low-PM firms) with those of full-sample model estimations. As tabulated in Table B.1 in Appendix B, the R^2 values for both the high- and low-PM groups are significantly greater than those of the full-sample analyses. This indicates that accounting for differences in PM substantially improves the explanation of variation in operational change and firm performance.

6. Robustness Tests

6.1. Alternative Sample-Splitting Procedure

One concern that may arise with our subgroup analysis is that observations around the mean of PM may be similar but be placed in different groups. To assess the sensitivity of our results to this splitting criterion, we exclude the observations in the middle of the distribution (i.e., those around the variable mean of 2.03) and reestimate the models. We compose the low-PM group of all firms with a score below 2 (n = 160, thus dropping 68 observations) and the high-PM group of all firms with a score of at least 2.33 (n = 190, thus dropping 39 observations).[28]

Tables B.2 and B.3 in Appendix B show that despite the reduction in sample size, results converge with those of the main analyses. Whereas in Table B.2 strategic change is significantly associated with subsequent operational change in both subgroups, the coefficient is significantly larger in the high-PM group ($p < 0.05$). In addition, after controlling for prior operational change, the coefficient of strategic change is no longer significant for low-PM firms, and the coefficient difference with the high-PM firms remains significant ($p = 0.05$). Similarly, in Table B.3, the coefficient differences and Wald tests indicate that the performance effects of implemented operational

changes are significantly greater for high-PM firms (test of differences across the four years: $p < 0.05$).

6.2. Differentiating Between Types of Performance Measures

Prior literature indicates that different types of performance measures can play different roles in strategy implementation. Nonfinancial measures are considered more timely and relevant to informing operational processes because they can be designed to suit the business processes of a firm, and their forward-looking nature helps to guide and motivate managers' long-term efforts (Ittner and Larcker 2001, Malina and Selto 2001). They typically include disaggregated and detailed measures of performance (Abernethy et al. 2004). In contrast, financial measures provide a more aggregate assessment of the effects of strategic and operational change and guide managers toward broader financial objectives. Although our factor analysis extracted one factor for all the items, a forced two-factor solution indicates that the first two PM items load more strongly on one factor (*financial PM*), whereas the last four PM items load more strongly on the other factor (*nonfinancial PM*). Based on this distinction, we explore potential differences of these types of measures in strategy implementation. Replicating our tests in Tables 4 and 5 for financial and nonfinancial measures separately (untabulated) provides a similar pattern of results as for the overall PM measure. This is consistent with the strong interrelations in the use of performance measures and indicates that firms typically use a combination of financial and nonfinancial measures to support the process of strategic change.

6.3. Modeling Firm Survival

Whereas our prior tests examine the influence of strategic and operational change on performance, in an additional test, we assess their effects on firm survival. We replace the performance change variables in Table 5 with an indicator of whether (1) or not (0) the firm, at the end of the panel window, survived and estimate the models using logistic regression.[29] Table B.4 in Appendix B shows that of all model variables, only operational change is significantly related to firm failure. The negative coefficient (−3.56; $p < 0.01$) supports the idea that operational changes reduce the chance of future firm failure. This finding holds for both the high- and low-PM groups, suggesting that in both groups the introduction of operational changes increases the likelihood of survival, although the impact of those changes on firm performance depends on PM use (see Table 5). Because we found that high-PM firms are more likely to translate initiated strategic change into operational changes (Table 4), these results suggest that the likelihood of survival is greater for high-PM firms implementing strategic change. Consistent with this inference, the proportion of firm failures is greater in the low-PM group (13.2%) than in the high-PM group (9.2%), and these proportions are similar if we consider only firms that initiated at least one strategic change (12.9% versus 9.4%). However, we caution that with "just" 11% of sample firms failing, the power of the test is relatively low. A sample with a greater proportion of failures, more firms, or a longer time window would provide a stronger difference test.

7. Discussion and Conclusions

Despite significant research attention in both the management and accounting literatures, there is much to understand about factors that influence the successful implementation of strategic change (Langfield-Smith 2007, Naranjo-Gil and Hartmann 2007, Franco-Santos et al. 2012, Herrmann and Nadkarni 2014). The objective of our study was to provide insights from a large-scale longitudinal data set as to the role of PM in the processual dynamics of strategic change and in particular its use in facilitating the effective implementation of strategic change through galvanizing effective operational change. This is the only large-scale quantitative study of which we are aware that uses longitudinal data to provide insights as to whether PM supports the processual dynamics of strategic change.

In modeling the processual dynamics of strategic change, we focus on both what is changed (the strategic level) and how it is carried out (the operational level; MacBryde et al. 2014). Consistent with recent literature, we conceptualize changes in a firm's strategic priorities broadly, to include changes to the content of the strategy as well as higher-order structural changes that both initiate and support these changes in content (Herrmann and Nadkarni 2014). We incorporate a time dimension and examine subsequent operational changes made by a firm when implementing changes in its strategic priorities.

Our results indicate that in these processual dynamics, the use of PM matters in the extent to which firms follow through with subsequent operational changes. We also find that changes in firm performance over time are effected by these operational changes and that these effects are conditional on firms' use of PM. Firms with greater use of PM on average experience better performance improvements from their implementation of operational changes both in the year of change and in subsequent years.

Our study contributes to the accounting and management literatures in several ways. First, it is one of a few studies to establish empirically the importance of PM in the processual dynamics of strategic change. Consistent with calls in the management literature to resolve equivocal findings as to the outcomes of strategic change programs (Pearce and Robbins 1993,

Herrmann and Nadkarni 2014), we investigate operational changes as an important mediating variable for the implementation of strategic change (Barker and Duhaime 1997, Trahms et al. 2013, Herrmann and Nadkarni 2014). Changing strategic priorities is not an end in itself; it must translate into the necessary actions at the operational level that enact these changes. Furthermore, although PM is theorized to signal and guide desired operational changes and therefore be important for the implementation of strategic change (Franco-Santos et al. 2012), most studies capture only the end-of-process effects of PM. The influence of PM on operational changes in the implementation of strategic change is seldom measured (MacBryde et al. 2014, Campbell et al. 2015). In capturing more of the complexities of strategic change, we provide a better understanding of the influence of PM on various distinct phases of strategic change. Our data allow us to unpack the intermediate and end-of-process effects of PM, which is important in unraveling equivocal findings as to the extent to which PM can assist firms to realize benefits from strategic change (Franco-Santos et al. 2012, Franco-Santos and Otley 2018). Our finding that PM influences both the extent of operational changes enacted to implement change and the effectiveness of these changes for performance outcomes reinforces the importance of studying strategic change as a series of interrelated processes.

Finally, we are also able to provide some empirical support for the theorized causal relations between strategic change and firm performance by using longitudinal data that link changes in strategic priorities to changes in the operational processes and actions that allow these initiatives to be implemented and then to the performance outcomes that occur as a result. We explicitly recognize the temporal progression of elements of strategic change, as recommended in recent research (Kunisch et al. 2017). Although we cannot demonstrate causality unequivocally, the longer time frame of our study does provide a more robust setting in which to examine change (Luft 1997).

As with most research, our study has a number of potential limitations. We used a third-party database administered by a statutory body that mandated compliance. Although this guarantees a high response rate, several trade-offs were made. First, we were not involved with the design of the survey, nor do we know the source of the measurement instruments. Some of the items in the survey did not use multi-item scales or used only dichotomous response categories, which is more commonly the case in business surveys administered by national statistics offices (e.g., Laursen and Salter 2006). The items are important in themselves because they form the basis of government statistics and potential decision making. The PM instrument did not allow us to identify how the measures were used, only the extent to which they were used for tracking and evaluating business performance. Similarly, although the data set allows us to identify elements of initiated strategic change, it does not capture the quality or appropriateness of the strategic decisions that are made that can influence subsequent operational and performance changes. There is also concern with the use of perception measures, particularly when they are used to capture firm performance. However, most measurement scales we use are of a more factual nature (e.g., increasing versus same or decreasing income), and we mitigate some of these concerns by providing evidence on construct validity and reliability and using alternative measurement instruments to demonstrate measurement validity for all of our test variables. Our longitudinal database with separate measurement moments also overcomes several of the measurement and econometric problems associated with the use of such data. In addition, we have information on performance outcomes for different time periods as well as factual measures, which we use to demonstrate construct validity (e.g., whether the firm reports increases in sales to the Australian Taxation Office or survives in the database). Our access to five years of matched firm data enables us to better approximate causal relations than would be possible in a cross-sectional data set or data sets that cover a shorter time frame. Finally, we acknowledge the limitations introduced by our assumption as to the temporal (linear) sequencing of strategic and operational changes. Although this assumption is consistent with the vast majority of the strategic change, operations management, and accounting literature, it does not capture the potential for feedback loops and recursive relations that occur in practice (e.g., Mintzberg 1989). The years for which data were available for relevant survey instruments precluded studying whether operational change may also precede strategic change.

Notwithstanding potential limitations, our findings speak to the importance of PM in the processual dynamics of strategic change. Our results highlight the importance of PM for both translating new strategic priorities into operational change within the organization and the effectiveness of implementation. Using longitudinal data of a relatively large sample of firms, we are able to demonstrate the importance of PM in processes of strategic change. Our findings have implications for firms looking to undertake strategic change. Prior research has documented that strategic change programs do not necessarily improve firm performance. The evidence provided here is that PM can play a critical role in ensuring that strategic change achieves its desired purpose; that is, it can help improve firm performance

through its role in promoting the implementation and effectiveness of strategically aligned operational changes.

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Appendix A. Summary of Variable Measurement

Model variable	Operationalization
Strategic change	Mean of six indicators as to whether (0 = no; 1 = yes) in 2005 the firm made significant changes to the (1) range of products or services offered, (2) area of distribution, (3) method of distribution, (4) market targeted, (5) management structure, and (6) business structure
Operational change	Mean of seven indicators that capture whether (0 = no; 1 = yes) the firm in 2006 introduced any new or significantly improved (1) methods of manufacturing or producing goods or services, (2) supporting activities for business operations, (3) other operational processes, (4) knowledge management processes, (5) major change to the organization of work, (6) changes to the design or packaging of a good or service, and (7) marketing methods for sales or distribution
Performance measurement	Mean of six items that reflect the extent to which the firm in 2006 focused on the following measures when evaluating business performance (0 = not at all; 1 = to a small extent; 2 = to a moderate extent; 3 = to a major extent): (1) financial measures, (2) cost measures, (3) operational measures, (4) quality measures, (5) innovation measures, and (6) human resources measures. The first two items capture *financial performance measures*, and the last four items capture *nonfinancial performance measures*
Performance change	Mean of three items that indicate how performance changed compared with the previous year (1 = decreased; 2 = stayed the same; 3 = increased) in (1) income from the sales of goods or services, (2) profitability, and (3) productivity
Resource constraints	Mean of 10 indicators as to whether in 2005 the following factors hampered the activities or performance of the firm (0 = no; 1 = yes): (1) cost or availability of finance, (2) federal government regulations or compliance, (3) state/territory government regulations or compliance, (4) local government regulations or compliance, (5) market dominated by other businesses, (6) lack of customer demand for goods or services, (7) market too small or unknown, (8) market power of suppliers or customers, (9) lack of equipment, machinery or technology, and (10) lack of skilled staff
Delegation	Indicator of whether (1 = no; 0 = yes) a single person in the business was responsible for major decisions on business operations
R&D	Indicator of whether (0 = no; 1 = yes) the firm in 2005 carried out any research and experimental development
Locations	Number of locations operated by the firm in 2005 (1 = one; 2 = two; 3 = three or more)
Competition	Indicator of the intensity of competition (1 = captive market/no effective competition; 2 = one or two competitors; 3 = three or more), with measurement matching the year of the related dependent variable
Firm age	The number of years that the firm has been in operation (1 = less than 5 years; 2 = 5 years to less than 10 years; 3 = 10 years to less than 20 years; 4 = 20 years or more)
Firm size	Log of total sales by the firm, with measurement matching the year of the related dependent variable
Firm industry	Indicator variables to separate firms active in production (30%), services (41%), merchandise (17%), and natural resources (12%)
Firm type	Indicator variable that differentiates between registered companies (denoted by 1) and other legal forms (e.g., partnerships) (denoted by 0)
Firm failure	Indicator variable whether (1) or not (0) the firm went bankrupt in the period up to 2009

Appendix B. Robustness Tests

Table B.1. Comparisons of Variance Explained Between Full Sample and Subsample Tests

	Panel A: R^2 firm performance change				Panel B: Overall model R^2			
	2006	2007	2008	2009	2006	2007	2008	2009
Full sample	0.113	0.127	0.149	0.109	0.240	0.256	0.257	0.247
High-PM sample	0.200	0.203	0.169	0.181	0.296	0.308	0.264	0.308
Low-PM sample	0.152	0.203	0.223	0.147	0.293	0.335	0.332	0.283

Notes. Panel A reports the variance explained relating to yearly firm performance change. Panel B reports the overall variance explained in both operational change (2006) and firm performance change (yearly) obtained from the SEM estimations.

Table B.2. Effects of Strategic Change on Operational Change for Subgroups with an Alternative Sample-Splitting Procedure

	Operational change 2006			
	Model 1		Model 2	
	High PM	Low PM	High PM	Low PM
Intercept	−0.02	−0.07	0.03	−0.07
	(−0.12)	(−0.60)	(0.20)	(−0.60)
Strategic change 2005	0.32***	0.13**	0.25***	0.08
	(4.75)	(2.23)	(3.63)	(1.36)
Operational change 2005			0.16***	0.10***
			(3.38)	(2.63)
Resource constraints 2005	−0.08	0.03	−0.08	0.02
	(−0.73)	(0.34)	(−0.74)	(0.33)
Delegation	−0.001	−0.02	0.001	−0.01
	(−0.03)	(−0.73)	(0.22)	(−0.57)
R&D	0.08**	0.07**	0.05	0.05
	(2.13)	(2.19)	(1.21)	(1.61)
Locations	−0.01	0.02	−0.003	0.02
	(−0.23)	(1.21)	(−0.12)	(1.21)
Competition	0.01	0.03**	0.003	0.03*
	(0.34)	(2.16)	(0.14)	(1.91)
Firm age	0.01	0.01	0.003	0.01
	(0.45)	(0.50)	(0.15)	(0.62)
Firm size	0.01	−0.002	0.01	−0.002
	(0.63)	(−0.25)	(0.42)	(−0.25)
Firm type	0.004	0.01	0.01	0.005
	(0.11)	(0.24)	(0.16)	(0.20)
Industry controls	Yes	Yes	Yes	Yes
F-test	1.75**	2.18***	2.32***	2.49***
R^2/adjusted R^2	0.17/0.07	0.24/0.13	0.22/0.13	0.28/0.16
N	190	160	190	160
Wald-test coefficient, difference of *strategic change* for high versus low PM	$\chi^2(1) = 3.32$**		$\chi^2(1) = 2.64$*	

Notes. For each variable in the first column there are two rows. The first row presents the coefficient estimate and the second row (in parentheses) presents the *t*-value. Measurement of *competition* and *firm size* is matched with the year of the dependent variable.

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$ (two-tailed).

Table B.3. Effects of Operational Change on Firm Performance Change with an Alternative Sample-Splitting Procedure

	Δ*Performance* 2006		Δ*Performance* 2007		Δ*Performance* 2008		Δ*Performance* 2009	
	High PM	Low PM	High PM	Low PM	High PM	Low PM	High PM	Low PM
Intercept	1.13**	1.09*	0.93*	0.84	0.48	−0.26	0.58	0.62
	(2.27)	(1.81)	(1.71)	(1.35)	(0.84)	(−0.46)	(1.08)	(1.18)
Operational change 2006	0.28	−0.42	0.47*	0.32	0.53**	−0.07	0.07	−0.68
	(1.28)	(−0.92)	(1.93)	(0.70)	(1.98)	(−0.15)	(0.27)	(−1.48)
Strategic change 2005	0.01	0.45	−0.33	0.30	−0.12	0.50	0.15	0.49
	(0.05)	(0.39)	(−1.41)	(0.94)	(−0.45)	(1.54)	(0.57)	(1.50)
Resource constraints 2005	−0.04	−0.79**	0.57	−0.37	−0.35	−0.64	−0.50	−0.02
	(−0.12)	(−1.99)	(1.54)	(−0.87)	(−0.86)	(−1.57)	(−1.24)	(−0.04)
Delegation	0.18*	−0.15	0.37***	−0.05	0.23*	0.09	0.13	−0.03
	(1.85)	(−1.31)	(3.36)	(−0.48)	(1.91)	(0.72)	(1.92)	(−0.22)
R&D	0.31***	−0.19	0.18	−0.17	−0.10	0.16	0.02	0.09
	(2.67)	(−1.03)	(1.42)	(−0.92)	(−0.74)	(0.88)	(0.12)	(0.51)
Locations	0.07	−0.01	0.09	−0.01	0.04	−0.01	0.02	0.04
	(1.13)	(−0.18)	(1.13)	(−0.14)	(0.52)	(−0.09)	(0.22)	(0.45)
Competition	−0.07	0.12	−0.21***	0.08	−0.22**	−0.05	−0.14*	−0.09
	(−1.23)	(0.42)	(−2.66)	(0.95)	(−2.57)	(−0.56)	(−1.70)	(−1.05)
Firm age	0.06	0.03	0.05	−0.15**	0.08	0.01	0.11	−0.07
	(1.06)	(0.55)	(0.77)	(−2.53)	(1.11)	(0.09)	(1.63)	(−1.19)
Firm size	0.04	0.05	0.07*	0.11**	0.12***	0.16***	0.11***	0.11**
	(1.20)	(1.05)	(1.70)	(2.56)	(2.84)	(4.12)	(2.72)	(3.02)
Firm type	−0.02	0.01	−0.04	−0.20	−0.06	0.06	−0.09	−0.05
	(−0.16)	(0.04)	(−0.34)	(−1.46)	(−0.39)	(0.41)	(−0.64)	(−0.50)
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-test	2.43***	1.41	2.52***	1.42	1.89**	2.20***	1.57*	1.74**
R^2/adjusted R^2	0.23/0.14	0.18/0.05	0.26/0.15	0.18/0.05	0.21/0.10	0.28/0.15	0.18/0.07	0.23/0.10
N	190	160	176	154	174	143	173	146
Wald-test coefficient, difference in *operational change* for high versus low PM	$\chi^2(1) = 1.80$*		$\chi^2(1) = 0.10$		$\chi^2(1) = 2.08$*		$\chi^2(1) = 3.49$**	
Indirect effect estimate of *strategic change* 2005	0.09	−0.06	0.15*	0.04	0.17*	0.003	−0.01	0.03
	1.31	−0.91	1.89	0.72	1.92	0.17	−0.16	0.29

Notes. For each variable in the first column there are two rows. The first row presents the coefficient estimate and the second row (in parentheses) presents the *t*-value (*Z*-value for indirect effects). Measurement of *competition* and *firm size* is matched with the year of the dependent variable. A Wald test shows that the subgroup differences between the coefficients of operational change over the four years are significant at the 1% level ($\chi^2(1) = 4.21$; $p < 0.05$).

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$ (two-tailed for coefficient estimates, one-tailed for coefficient difference tests).

Table B.4. Logit Estimation of Firm Failure

	Firm failure		
		Subsample results	
	Full sample results	High PM	Low PM
Intercept	1.81	−15.24***	3.87
	(1.19)	(−4.08)	(1.63)
Operational change 2005	−3.56***	−2.74*	−4.37*
	(−2.73)	(−1.66)	(−1.72)
Strategic change 2005	0.29	−1.13	1.03
	(0.37)	(−0.88)	(0.86)
Resource constraints 2005	1.49	1.34	1.47
	(1.47)	(0.72)	(1.07)
Delegation	−0.35	−0.78	−1.50
	(−1.09)	(−1.36)	(−0.34)
R&D	−0.91	−1.67	−0.40
	(−1.44)	(−1.41)	(−0.46)
Locations	−0.27	−0.19	−0.53
	(−1.06)	(−0.49)	(−1.34)
Competition	−0.04	0.29	−0.26
	(−0.10)	(0.63)	(−0.88)
Firm age	−0.17	−0.37	−0.19
	(−1.01)	(−1.34)	(−0.83)
Firm size	−0.23*	−0.27	−0.30*
	(−1.90)	(−1.40)	(−1.78)
Firm type	0.01	0.15	−0.18
	(0.03)	(0.24)	(−0.38)
Industry controls	Yes	Yes	Yes
Likelihood ratio χ^2	40.42***	37.60***	23.68
Pseudo R^2	0.13	0.27	0.21
N	457	229	228

Note. For each variable in the first column there are two rows. The first row presents the coefficient estimate and the second row (in parentheses) presents the Z-value.

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$ (two-tailed).

Endnotes

[1] See, for example, the early work of Daft and Macintosh (1984), the seminal work of Simons (1987, 1990, 1991, 1994), and reviews by Langfield-Smith (1997, 2007), Franco-Santos et al. (2012), and Herschung et al. (2018).

[2] See, for example, Abernethy and Brownell (1999) and Naranjo-Gil and Hartmann (2007).

[3] Whereas we study operational changes that occur as part of the strategic change process, the literature also highlights other important aspects of processes of strategic change, including, among other things, the role and influence of managers (e.g., Herrmann and Nadkarni 2014). Our database lacks measures to examine manager effects; however, in the analyses, we control for prior-year operational change, which, if systematically influenced by firm and manager characteristics, effectively controls for these fixed effects.

[4] Similarly, the accounting literature has typically assumed that logical and causal relations exist between dimensions of organizational performance (such as those reflected in strategy maps that underpin the balanced scorecard; Neely 2005), although some authors have acknowledged the potential in practice for such relations to be dynamic and recursive in nature (e.g., Nørreklit 2000).

[5] We also note that studies have examined operational changes in isolation from firm strategy. However, literature suggests that operational change in and of itself is not necessarily value enhancing. For example, in the turnaround literature, the impact of operational changes such as cost retrenchment (to improve efficiency) or asset retrenchment (i.e., divestments) on firm performance remain unclear (for a review, see Trahms et al. 2013).

[6] The variety in types and combinations of performance measurement features studied in the literature is reflected in a breadth of nomenclature, which includes contemporary (Franco-Santos et al. 2012), comprehensive (Hall 2008), integrated (Bititci 2007), and strategic (Chenhall 2005) PM systems, among others.

[7] Note that our conceptualization of strategic change includes structural adaptations at the corporate level (i.e., changes to management and business structures) consistent with the perspective that such adaptations precede and are distinct from operational actions made to implement strategic change. Thus, we conceptualize the distinction between strategic change and operational change as relating to the level of decision making, that is, strategic-level and operational-level decisions, respectively.

[8] Ideally, we would assess the moderation effect of PM on subsequent value-enhancing operational changes (i.e., capturing both the quantity and quality of operational changes) and their direct effects on firm performance. Because our empirical measure of operational change is limited to the quantity of change, we instead assess the moderating effects of PM on both the extent of operational changes and their subsequent performance effects.

[9] The researchers had no involvement in the design of the survey and obtained access to the data after they had been collected by the ABS.

[10] Firms are drawn from the ABS business register, which includes all businesses and organizations issued an Australian Business Number (which most businesses and organizations are required to obtain in order to conduct business). Although there are other forms of more complex businesses contained in the ABS business register, the BLD is limited to those with Australian Business Numbers.

[11] Some changes to the content of the survey occurred in early iterations as its purpose and scope were refined. The main impact of these changes on our analyses is that some of the variables of interest (e.g., those relating to strategic change) were considered by the ABS as "noncore" and are available for only part of the five-year window.

[12] Indeed, firms with fewer than 20 employees make substantially less use of PM (mean = 1.57), as operationalized in Section 4 (see also Table 3 for sample descriptives).

[13] The last item refers to the firm's domestic market. We exclude another item in the BCS that captures changes in the firm's export markets because many firms in the sample did not have sales from exporting.

[14] Because the measurement instrument asked respondents to indicate "significant changes made to" each item within the year, the items reflect substantial change that will take time to fully implement and for performance effects to occur. Empirically, we model this process by including lagged effects in operational change and firm performance.

[15] For example, the content dimension of initiated change includes "range of products and services" rather than yearly changes in goods and services.

[16] The five items were measured only in 2007 and capture whether the firm had any expenditure for innovation on the following: (1) acquisition of machinery, technology, or equipment, (2) specific training, (3) marketing activities, (4) research and experimental development, and (5) acquisition of licenses, rights, patents, or other intellectual property. We take the sum as an overall measure of expenditure and compute the correlation for the 2007 measures. Correlating the expenditure measure with the 2006 score for operational change provides a similar correlation ($r = 0.16$; $p < 0.01$) and conclusions about construct validity.

[17] The correlations of the four items with the 2005 PM measure are also positive and significant ($r = 0.37$, 0.32, 0.20, and 0.45; all $p < 0.01$), which similarly supports convergent validity. A benefit of using temporally separated measurement of the different items (i.e., 2005 versus 2006) is that this avoids potential common method bias.

[18] We consider the performance change variable to be more appropriate for our empirical tests because many of the operational changes (e.g., changes in manufacturing or work methods) that we examine are not per se oriented toward increasing sales, and their effects are better captured by the indicators of profit and productivity.

[19] The three-item measure of performance change without imputation for all years (2006–2009) is negatively associated with firm failure ($r = -0.22$, -0.34, -0.40, and -0.43; $p < 0.01$). Firms not surviving to the end of the sample period also have significantly worse changes in reported sales ($r = -0.22$; $p < 0.01$) and in 2005 indicated worse performance relative to competitors ($r = -0.18$; $p < 0.01$) than surviving firms.

[20] As a validity test, we correlate the construct with an item asking whether the firm in the respective year experienced skill shortages. Firms that did experience skill shortages score higher on resource constraints ($r = 0.23$; $p < 0.01$). Resource constraints further correlate negatively with a measure of the firm's performance relative to competitors in the same year ($r = -0.12$; $p < 0.01$) and positively with application for debt financing the next year ($r = 0.14$; $p < 0.05$). This supports the idea that firms with greater constraints perform relatively more weakly and are more in need of financing.

[21] Descriptive statistics for the high- and low-PM subgroups show that in both subgroups there is significant variation in all key constructs (strategic change, operational change, performance change), which supports conducting within-group estimations and between-group comparisons.

[22] The SEM estimations are based on ML estimation. In all SEM estimations, the direct effects and significance levels are similar to those of the corresponding OLS estimations.

[23] The BLD data set can be analyzed at the ABS premises or by submitting code through an online interface, and researchers are not permitted to obtain the data set or portions of it directly. We have spent a substantial amount of time at the ABS premises to get familiar with the data set and develop code for analysis. Later model runs were conducted through the online interface, except for the SEM analyses, which were not supported on the online interface and for which our code was executed by an ABS officer in a more recent version of Stata.

[24] As Table 2 indicates, operational change is not normally distributed because many firms do not engage in change, whereas a proportion engages in medium to much change. Based on the data distribution, we recode operational change into four categories (zero, one, two, or more than two changes) to test for robustness of the findings. For Models 4 and 5, results are very similar. Similarly, Poisson regressions on the number of operational changes introduced provide results and significance levels similar to those reported in Table 4.

[25] If we use the Model 4 regression coefficients in Table 4 (which control for prior operational change), results are similar.

[26] Although we find no significant group difference in the effect of operational change on 2007 performance change, we find a difference in indirect effects that derives from the differential influence of strategic change on operational change.

[27] The R&D measure was available only for 2005, and the absence of significant associations in later years may relate to unmeasured changes in R&D activities over time.

[28] Because the PM construct is the average of six items measured on a scale of 0–3, a score of at least 2.33 requires firms to use at least two performance measures to a "major extent" and ensures that all observations with the next possible score after the variable mean are dropped.

[29] Negative binomial regression, which better accounts for the infrequent occurrence of firm failure, provides results similar to those reported in Table B.4.

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